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Question Paper Code : 21395

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Fourth Semester

Electrical and Electronics Engineering

EE 2251/EE 42/EE 1251 A/10133 EE 402/080280003 — ELECTRICAL MACHINES –I

(Regulation 2008/2010)

(Common to PTEE 2251–Electrical Machines – I for B.E. (Part-Time) Third Semester Electrical and Electronics Engineering – Regulation 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the basic types of rotating electric machines?

2. Draw the typical magnetization curve of ferromagnetic material.

3. What are the losses in a transformer?

4. List out any four three phase transformer connections.

5. What do you mean by co-energy?

6. Give examples for multiple excitation systems.

7. Write down the expression for torque in round rotor machine.

8. Why fractional pitched winding is preferred over full pitched winding?

9. Write down the applications of d.c. series motor.

10. What is meant by armature reaction?

PART B — ($5 \times 16 = 80$ marks)

11. (a) Draw and explain the typical magnetic circuit with air-gap and its equivalent electric circuit. Hence derive the expression for air-gap flux. (16)

Or

(b) The magnetic circuit has dimensions: $A_c = 4 \times 4$ cm^2, $l_g = 0.06$ cm, $l_c = 40$ cm and N = 600 turns. Assume the value of $\mu_r = 6000$ for iron. Find the exciting current for $B_c = 1.2$ T and the corresponding flux and flux linkages. (16)

12. (a) Explain the constructional details and working of core type and shell type transformers with neat sketches. (16)

Or

(b) Obtain the equivalent circuit of a 200/400 V, 50 Hz, 1-phase transformer from the following test data:

O.C. test: 200 V, 0.7 A, 70 W – on L.V side

S.C. test: 15 V, 10 A, 85 W—on H.V side

Calculate the secondary voltage when delivering 5 kW at 0.8 p.f. lagging, the primary voltage being 200 V. (16)

13. (a) Derive an expression for the magnetic force developed in a multiply-excited magnetic systems. (16)

Or

(b) Find an expression for the force per unit area between the plates of a parallel plate condenser in terms of the electric field intensity. Use both the energy and co-energy methods. Find the value of the force per unit area when $E = 3 \times 10^6$V/m, the breakdown strength of air. (16)

14. (a) (i) Derive an expression for the generated voltage of d.c. machine. (8)

(ii) Calculate the fundamental, third and fifth harmonic breadth factors for a stator with 36 slots wound for 3-phase, 4-pole. (8)

Or

(b) A 3-phase, 50 Hz, star-connected alternator with 2-layer winding is running at 600 rpm. It has 12 turns/coil, 4 slots/pole/phase and a coil-pitch of 10 slots. If the flux/pole is 0.035 Wb sinusoidally distributed, find the phase and line emfs induced. Assume that the total turns/phase are series connected. (16)

15. (a) With schematic diagrams, explain the working principle of different types of dc generator based on its excitation. (16)

Or

(b) Explain the different methods of speed control of dc shunt motor with neat circuit diagrams. (16)

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